Woodbury University

School of Architecture

Applied Computer Science – Media Arts

Course Title: Introduction to 3D worlds

Course Number: CSMA 111

Units: 3

Semester: Spring

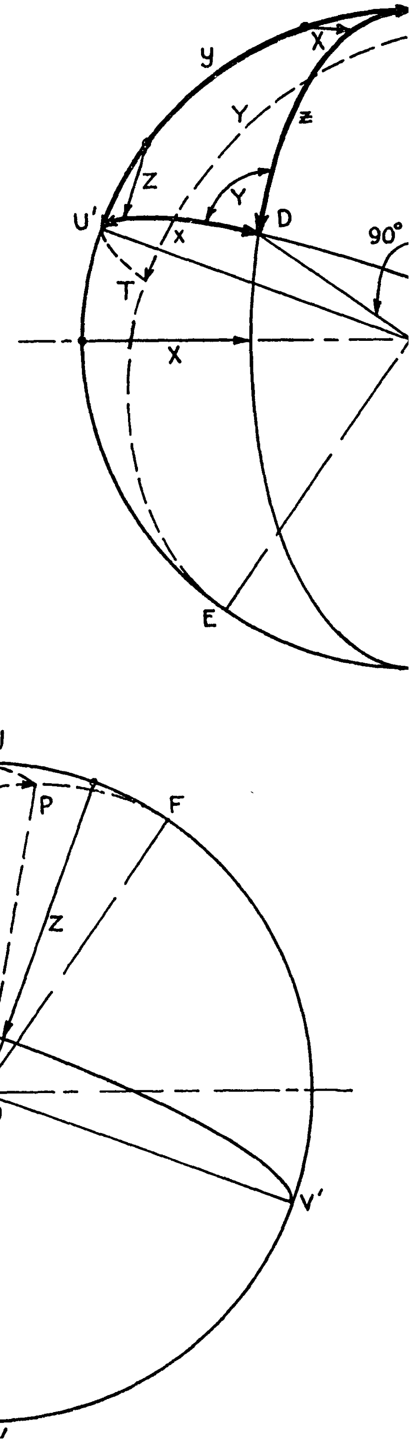
Year: 2020

Prerequisites: None

Instructor: Mark Ericson

Email: mark.ericson@woodbury.edu

Office Hours: TBD



Milton Felston, On Spherical Drawing and Computation, 1955

Catalog Description:

This course serves as an introduction to three-dimensional environments. During the term of the course, students will learn to model and work within the virtual 3-D space. Students will build complex objects, and then learn 3-D rendering and use of animation tools. Students will also learn digital fabrication techniques by making physical 3-D objects using laser cutters, 3-D printers, and CNC milling technology. Studio.

Program Learning Outcomes:

- Students will demonstrate proficiency in working with computer-generated image data and the practice of computational design.
- Students will develop the skills to produce media for a variety of contexts and will create software that incorporates motion, image, and video processing.
- Students will develop strong visual communication skills and design aesthetics.

Core Competencies:

- Quantitative Reasoning
- Critical Thinking

Strategic Principles:

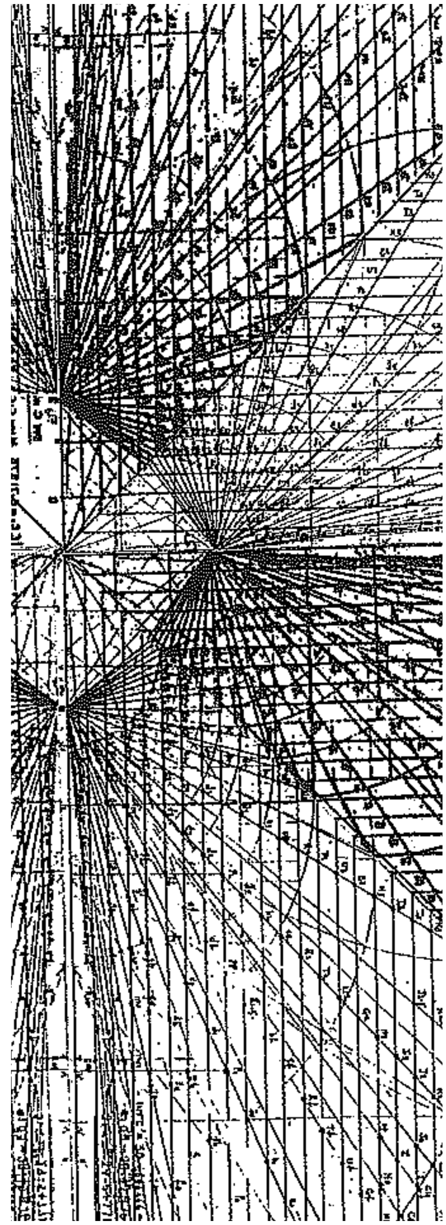
- Design Thinking: Demonstrates iterative processes to create impactful and innovative solutions

Round Things

If we construct a material circle, measure its radius and circumference, and see if the ratio of these two lengths is equal to π , what shall we have done? We shall have made an experiment on the properties of the matter with which we constructed this round thing, and of that which the measure used was made. (Henri Poincare, Science and Hypothesis, 1902)

The circle is an organic, ideal, fixed essence, but roundness is a vague and fluent essence distinct both from the circle and things that are round(a vase, a wheel, the sun. (Gilles Deleuze and Felix Guattari, A Thousand Plateaus, 198)

A circle is a mathematical abstraction, and it cannot be materialized. This is a simple but also disconcerting statement. We have been exposed to drawing circles from the earliest moments of our education. As a term it is embedded in our language used to describe a variety of images, objects, and spaces. It is one of the most ordinary geometries. Nonetheless, we can neither draw nor build a circle. We can describe it as, Poincare points out, by ratio of its radius and its circumference. We can also make a rough material approximation, a "round thing", with a compass, a string, or a computer and a numerically controlled cutting device. In the construction of these "round things" the circle's role is that of an instrument. The circle's abstract geometric properties are used to define this new material thing that although it is round, is not a circle. In this instance the circle is an instrument, used to define new forms through its geometric properties.

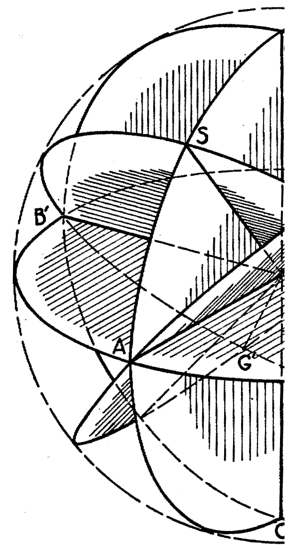


John Pickering, Inverting a Cylinder with respect to Point lying on a Sphere

The cone, the sphere, and the cylinder are geometric solids derived from a circle. Within our contemporary digital framework a cone is a singular object that is a built-in component in most software platforms, a primitive. The same could be said for the sphere or the cylinder. However, these singular forms are composed of sets of simpler geometric elements: the circle and the line. In the history of drawing, the ability to break down the cone, the sphere, and the cylinder into specific geometric properties has made these figures not only significant formal elements but also drawing instruments in their own right. Stereotomy, the drawing practice used to develop the shape of stones within vaults is a central example of this. Within this drawing practice cones were used to draw toroidal vaults, hemispherical domes, and simply to break down spheres into developable surfaces. These three simple solids, the cone, the sphere, and the cylinder can therefore be understood as geometric elements capable of describing forms of a higher degree of complexity then themselves. Like the circle, cones, spheres, and cylinders are ideal forms that cannot be materialized.

By extending this logic into the digital realm, it is possible to imagine geometric primitives not only as something to be aggregated, intersected with, or subtracted from but as drawing instruments. Drawings instruments that are capable describing forms more complex then themselves. This stuidio will study the properties of the circle the and solids that can be derived from it as tools for the production of form. In lieu of understanding the history of geometry and drawing as a linear trajectory of progress it will position different epochs as collaborators in the development of form. Students will engage the history of drawing not as a point of reference, but rather as an active participant in the design process.

Assingment 1: Round Drawings



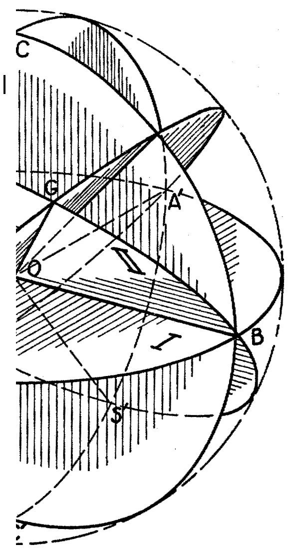
The semester will begin with the study and development of the techniques of drawing. At the core of this exercise will be a discussion of what constitutes a drawing. Circles and Spheres will be reduced to their fundamental geometric properties and used as drawing instruments to created animated drawings. Students will learn the basics of the programming language of Python in the open-source software platform Processing.py.

Assignment 2: Round Objects

In this phase students will explore use the geometric principles and programming techniques acquired in the first phase to develop round solid objects. Issues relating to surface, line, color and lighting will explored through the production of images, animations, and drawings. Students will learn to use the Python editor in the software Rhinoceros 6.0, in the process gaining access to Rhinoceros's powerful libraries of Rhinsript and Rhincommon.

Assignment 3: Round Worlds

In the last and final phase of the semester, students shift scales from object to space. Students will revisit the geometries and programming work of the first two phases of the semester and build objects with internal spaces. In addition to continuing to refine the drawing, rendering, and animation techiques introduced in the first phase of the semester, students will learn how to prepare files for fabrication on the laser cutter and 3D printer. However, due to the pandemic, no physical objects will be required or graded during the course of the semester. Students will learn to use the visual programming environment of Grasshopper in Rhinoceros 6.0. The programming language of Python will be used to develop individual components (nodes) in Grasshopper.



Milton Felston, On Spherical Drawing and Computation, 1955

COURSE LEARNING OUTCOMES:

Upon completion of this course, it is expected that students will be able to:

- Computational Modeling: Create a computational model using both visual programming and text based programming tools with a legible organization.
- Design Communication: Create images that correspond to the conventions of design communication such as plans, sections, axonometrics, renderings, and animations.
- Computational Principles: Enumerate basic principles of design computation.
- Graphic Precision: Compose images, animations, and drawings with a high degree of graphic precision as represented in the use of line-weights, linetypes, colors, resolution, lighting, and depth.
- Professionalism: Participate in the learning environment in a professional manner as exhibited by attendance and weekly progress.

ACTIVITIES:

Assignments:

There are (3) graded assignments. Each assignment will contain a set of requirements and schedule. Students are expected to complete the assignment by the date listed on the assignment.

Workshop Sketches:

Students are required to post a (2) Sketches for every Workshop of the semester. Sketches Are due on Wednesday at 11:30 am. All sketches are to be 1000 x 1000 pixels. Sketches may either be animated or stills. There are no sketches due on the first or the last week of classes. Students will receive credit or no credit for each sketch, based only on completion. Sketches are to be completed during the class time and posted to the shared class conceptboard [here.](#) Students who are absent are required to post sketches prior to the start of the next class meeting.

Lecture:

During lecture the instructor will present a set of concepts illustrated through images and text. Students are expected to participate by taking notes and asking questions. Lectures will be recorded and made available on the course moodle page.

Tutorial:

The instrumental focus of the class will require a significant amount of time to be dedicated to learning software. During workshops the instructor will demonstrate techniques related to the design problem. Following the demonstration students will repeat the work of the demo and expand it to address the specific problems of their individual project. Workshops will be made available on Microsroft stream. They can be found here. Students must use their Woodbury email for access.

Workshop:

During workshops students will work individually on their sketches that are due at the end of class time. In addition, students will meet with the instructor individually to receive feedback on their ongoing work.

Reading Discussion:

Short reading assignments will be embedded in the three assignments. Each reading will help to present fundamentals of design as well as specific issues related to the design problem. In the first class following the distribution of the assignment, students will be expected to participate in discussion of the reading through the production of a list of written questions. These questions will be used to generate topics of discussion.

Review:

Due to the collaborative nature of the class, reviews will be structured to discuss the work of the collective. They will operate as means to exchange design ideas, discuss the artifacts of design as well as index the terminus a phase of work. Students are expected to attend, discuss and question the work. We will use the platform Concept Board. Students can access through this link.

COURSE BIBLIOGRAPHY:

All assigned readings will be provided on Moodle. The list below provides a set of resources to supplement in-class learning. The publications will be made available as a course reserve in the library, as e-publications, or as pdfs on moodle:

Bruegmann, Robert. “The Pencil and the Electronic Sketchboard : Architectural Representation and the Computer.” In Architecture and Its Image : Four Centuries of Architectural Representation : Works from the Collection of the Canadian Centre for Architecture, edited by Eve Blau and Edward Kaufman. Cambridge: MIT Press, 1989.

Cache, Bernard. Projectiles. Architecture Words 6. London: AA Publications, 2011.

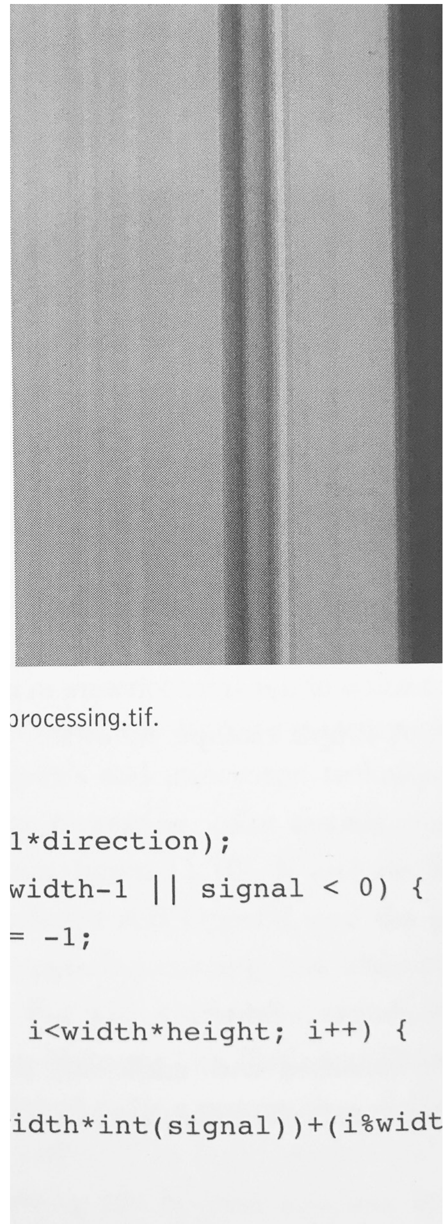
Casey Reas, Ben Fry, and Allison Parrish. Getting Started with Processing.Py. San Francisco: Maker Media, 2016

Casey Reas, and Chandler McWillaims. Form + Code. New York, N.Y.: Princeton Architectural Press, 2010.

Hilbert, D., and S. Cohn-Vossen. Geometry and The Imagination. New York: Chelsea, 1952.

Legendre, George. Mathematical Form. London: AA, 2006.

Lostritto, Carl. Computational Drawing. Applied Research and Design, 2019.



Software: Case Reas and Ben Fry, Processing , 2002- Present

Maeda, John. Creative Code. New York, N.Y.: Thames & Hudson, 2004.

Manovich, Lev. Software Takes Command : Extending the Language of New Media. International Texts in Critical Media Aesthetics ; #5. London: Bloomsbury Publishing, 2013.

Peters, Brady, and Daniel Davis. "Design Ecosystems: Customising the Architectural Design Environment with Software Plug-Ins." Edited by Xavier De Kestelier and Brady Peters. Architectural Design, Building of Algorithinc Thought, 83, no. 2 (April 2013).

Woodbury, Robert. Elements of Parametric Design. Routledge, 2010.

SOFTWARE EDUCATION

Students will be provided with detailed tutorials in class, but it is both expected and required that students research and acquire technical expertise outside of class. This is a central component each students continued development in architecture. Software does not last long. It is necessary learn new tools on a regular basis.

Detail: Casey Reas, A Mathematical Theory of Communication, 2018

Python Reference:

This website provide links to references and general help in Python.

https://www.python.org/

Processing.py

References and Examples of python in Processing.py

https://py.processing.org/

Grasshopper Forums:

Use the forums to receive help in problems and share your knowledge with others:

https://discourse.mcneel.com/c/grasshopper

The Grasshopper Primer:

The Grasshopper Primer by Andrew Lyft is now somewhat outdated but its basic principles and organization still operate as a great introduction: http://www.liftarchitects.com/blog/2009/3/25/grasshopper-primer-english-edition

Another version of the primer is also available from Mode Lab:

https://www.modelab.is/grasshopper-primer/.

Rhino Python Primer

This provides references on using python inside of Rhino.

https://www.rhino3d.com/download/IronPython/5.0/RhinoPython101

Grasshopper Tutorials:

Grasshopper maintains an extensive list of links to free tutorials and primers.

https://www.grasshopper3d.com/page/tutorials-1

Software tutorials on Lynda

If you obtain a Los Angeles Public Library card you can get free access to the tutorials on Lynda.com. This a good resource and it is free.

https://www.lapl.org/collections-resources/online-learning

ASSESSMENT AND GRADING:

Round Drawings: 25%

Round Objects: 25%

Round Worlds   40%

Sketches: 10%

At the conclusion of each assignment students will receive a rubric that breaks down the grade of each assingment in terms of the course learning outcomes. The categories of each rubric will be as follows:

Computational Modeling (20%):   Create a computational model using both visual programming and text based programming tools with a legible organization.

Design Communication (20%): Create images that correspond to the conventions of design communication such as plans, sections, axonometrics, renderings, and animations.

Computational Principles (20%): Enumerate basic principles of design computation.

Graphic Precision (20%): Compose images, animations, and drawings with a high degree of graphic precision as represented in the use of line-weights, line-types, colors, resolution, lighting, and depth.

Professionalism (20%): Participate in the learning environment in a professional manner as exhibited by attendance and weekly progress.

SCHOOL OF ARCHITECTURE POLICIES

Excused Absence

Students should report any illness or emergency to their course instructor, preferably before missing the class, by emailing the instructor. Written documentation (doctor’s note, etc.) is required for an excused absence, and should be submitted to the instructor at the next class meeting. Extended absence due to medical issues, family issues, etc. should be reported to the Dean of Students’ office for appropriate documentation.

Students who anticipate absence due to religious observance or similar commitments should speak with their instructor at the start of the term to review all dates in question and develop a plan to meet all course requirements.

Grievance Protocol

Students should use the following protocol for questions, grievances, or general concerns about coursework and the studio environment. Health and safety concerns and emergencies should immediately be directed to campus security (818-252-5208). Academic concerns should be directed first to the student's instructor, and then to the studio coordinator as appropriate. If further consultation is required, the student is advised to meet with the Coordinator and/or the Department Chair.

Class Syllabus and Structure

While every effort will be made to follow the outline of the published syllabus, course structure and calendar may be changed at the instructor or coordinator's discretion. Announcements will be made if such changes occur. Students who miss class are responsible for tracking any such announcements.

Studio Culture

The studio environment is an essential component in an education in the arts. One goal of the School of Architecture is to create a vibrant, exploratory, safe and respectful learning culture for students. Only through respect between faculty and students, as well as students among themselves, can a healthy educational studio culture be fostered. Students are required to uphold high standards of behavior and academic discipline while in the studio.

School Policy on Social Equity and Diversity

Our mission is to provide an environment where people can learn, teach and work with a shared sense of purpose, core values and respect without bias towards individual beliefs, values and areas of difference. We do this in an effort to create a community that respects and values the full and equal inclusion of its members. Our goal is to provide an environment that is welcoming and inclusive of all.

Woodbury University policies

Academic Honesty.

Because the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required at Woodbury University. Academic integrity is important for two reasons: first, independent and original scholarship ensures that students and scholars derive the most from their educational experience and the pursuit of knowledge. Second, academic dishonesty violates the most fundamental values of a community of scholars and depreciates the achievements of the entire University community. Accordingly, Woodbury University views academic dishonesty as one of the most serious offenses that a member of our community can commit. Adherence to the Academic Honesty Policy reflects the commitment of our community to the ideals of learning, research, and scholarship. See Catalog for the entire Academic Honesty Policy.

Accommodations for students with identified disabilities.

Woodbury University is committed to making reasonable accommodations to assist individuals with disabilities in reaching their academic potential. Students desiring accommodations due to a physical, learning or psychological disability must first complete an Accommodations Request Form, which can be downloaded from http://go.woodbury.edu, and found under "Academic Resources." Accommodations cannot be granted prior to the instructor's receipt of a Notification of Academic Accommodation Plan (NAAP) from the Disabilities Coordinator. Accommodations are never provided retroactively. (For more information, contact the Disabilities Coordinator in the Whitten Center (818) 394-3345.)

Communication between university faculty or staff and students.

Due to confidentiality and FERPA requirements all faculty, staff and students, when corresponding through email, must use their university provided Woodbury.edu email accounts. Students are encouraged to check this email address regularly as it is the only email address in which they will receive official course or university information.

Recording Lectures.

Students who have a documented accommodation may use their cell phones to record lectures. Students who have been approved by ODAS to record lectures must have their instructor sign off on this request, and must turn off their recording device when directed by the class instructor.

Protecting Privacy and Data During Remote Instruction.

This class is being conducted over Ring Central and Moodle. As the host, the instructor may be recording the sessions. The recording feature for others is disabled so that no one else will be able to record the sessions. No recording by other means is permitted except as an ODAS approved accommodation. The sessions will be posted on the Moodle class website unless otherwise notified. In case of privacy concerns and individual students wanting not to appear in the recording, the student must contact the Office of Student Affairs and apply for an exemption. Students must complete an Accommodations Request Form, which can be downloaded from http://go.woodbury.edu, and found under "Academic Resources." Accommodations cannot be granted prior to the instructor's receipt of a Notification of Academic Accommodation Plan (NAAP) from the Disabilities Coordinator. Accommodations are never provided retroactively. If the student prefers to use a pseudonym instead of the real name, please let the instructor know what name will be used so that the instructor knows who you the student is during the session.

Web Cam Usage.

Policy on web cam usage is that instructors may ask students to use devices that have video cameras and microphones and to have their video cameras on during class meetings. Instructors will need to be sensitive to students' needs.

COURSE POLICIES

Attendance

As a class focused on the acquisition of instrumental knowledge, attendance is central. Students will be graded on attendance during each of the three phases of work. Each missed class that has not be an excused will result in a 1 grade point deduction in the category of Professionalism on the assignment rubric. More than 2 absences during a given phase of work will result in a "0" for Professionalism.

Submitting Late Work:

All work must be digitally submitted to moodle on the date provide on the assignment. One-half letter grade will be deducted for each 24 hour period following the submission deadline. Work later than 72 hours will receive an "F."

Use of cell phones, or other technology during the class meeting:

The use of cell-phones, tablets, or computers is permitted as long as it pertains to the work of the class.

Formatting or quality of submitted work:

All work must be submitted digitally. Each assignment should be posted to moodle as a file or a link prior to the first-class meeting directly following each review. Students may make changes to the work after the review to improve their grade based on comments received at the review. No changes will be accepted after the due date. All work must be submitted in the following format:

- Single Bound PDF: Last Name_Firstname_CSMA4701_Fall 2020
- Every Page of the PDF should be PNG image file at resolution of 300 dpi.
- No crop marks or oversized pages should be included in the PDF.

Calculation of Grade

Letter grades are converted to numeric values using the following values:

Letter	GPA	%	Definition
A	4.00-3.84	96-100	Student learning and accomplishment far exceeds published objectives for the course/test/assignment and student work is distinguished consistently by is high level of competency and/or innovation.
A-	3.83-3.50	92-95	
B+	3.49-3.17	88-91	Student learning and accomplishment goes beyond what is expected in the published objectives for the course/test/assignment and student work is frequently characterized by its special depth of understanding, development, and/or innovative experimentation.
B	3.16-2.84	84-87	
B-	2.83-2.50	80-83	Students learning and accomplishment meets all published objectives for the course/test/assignment and the student work demonstrates the expected level of understanding, and application of concepts introduced.
C+	2.49-2.17	76-79	
C	2.16-1.84	72-75	
C-	1.83-1.50	68-71	Student learning and accomplishment based on the published objectives for the course/test/assignment were met with minimum passing achievement.
D+	1.49-1.17	64-67	
D	1.16-0.60	60-63	
F	0.00-0.60	< 60	Student learning and accomplishment based on the published objectives for the course/test/assignment were not sufficiently addressed nor met.

`	Date	Assignment	Software	Reading	Skills	
1	1.11: Lecture 1.13: Tutorial	Round Drawings	Process- ing.Py	Lostritto, Carl. Computational Drawing. Applied Research and Design, 2019.	Line weight, drawings with trignometry,	
2	1.18: NO CLASS 1.20: Wokshop	Round Drawings	Process- ing.Py		Line weight, drawings with trignometry, color	
3	1.25: Tutorial 1.27: Workshop	Round Drawings	Process- ing.Py		Line weight, drawings with trignometry, color	
4	2.01: Tutorial 2.03: Workshop	Round Objects	Rhino/Py- thon	Casey Reas, and Chandler McWil-laims. Form + Code. New York, N.Y.: Princeton Architectural Press, 2010	Nurbs, mesh, solids operations, contouring, animating	v
5	2.08: Tutorial 2.10 Wokshop	Round Objects	Rhino/Py- thon		Nurbs, mesh, solids operations, contouring, animating	
6	2.15: NO CLASS 2.17: Review 1	Round Objects	Rhino/Py- thon		Nurbs, mesh, solids operations, contouring, animating	
7	2.22: Lecture 2.24: Workshop	Round Worlds	Rhino/GH	Legendre, George. Math-ematical Form. London: AA, 2006.	Nurbs, mesh, solids operations, contouring, animating	
8	3.01: Tutorial 3.03: Workshop	Round Worlds	Rhino/GH	Legendre, George. Math-ematical Form. London: AA, 2006.	Nurbs, mesh, solids operations, contouring, animating	
9	3.08: Tutorial 3.11: Workshop	Round Worlds	Rhino/GH		Visual Pro-gramming Introduction List and trees	
10	3.15: NO CLASS 3.17: NO CLASS	SPRING BREAK				

11	3.22: Tutorial 3.24: Workshop	Round Worlds	Rhino/GH	Peters, Brady, and Daniel Davis. “Design Ecosystems:. 83, no. 2 (April 2013).	Building clusters
12	3.29: Tutorial 3.31: NO CLASS	Round Worlds	Rhino/GH		building components
13	4.05: Tutorial 4.07: Workshop	Round Worlds	Rhino/GH		Image/Drawing output
14	4.12: Tutorial 4.15 Workshop	Round Worlds	Rhino/GH		Animation output
15	4.19: Tutorial 4.21 Workshop	Round Worlds	Rhino/GH		Fabrication
16	4.26: Lecture	Round Worlds	Rhino/GH		computational modeling, axonometry, fabrication
17	5.05: FINAL REVIEW (TBD)				